Fig. 1

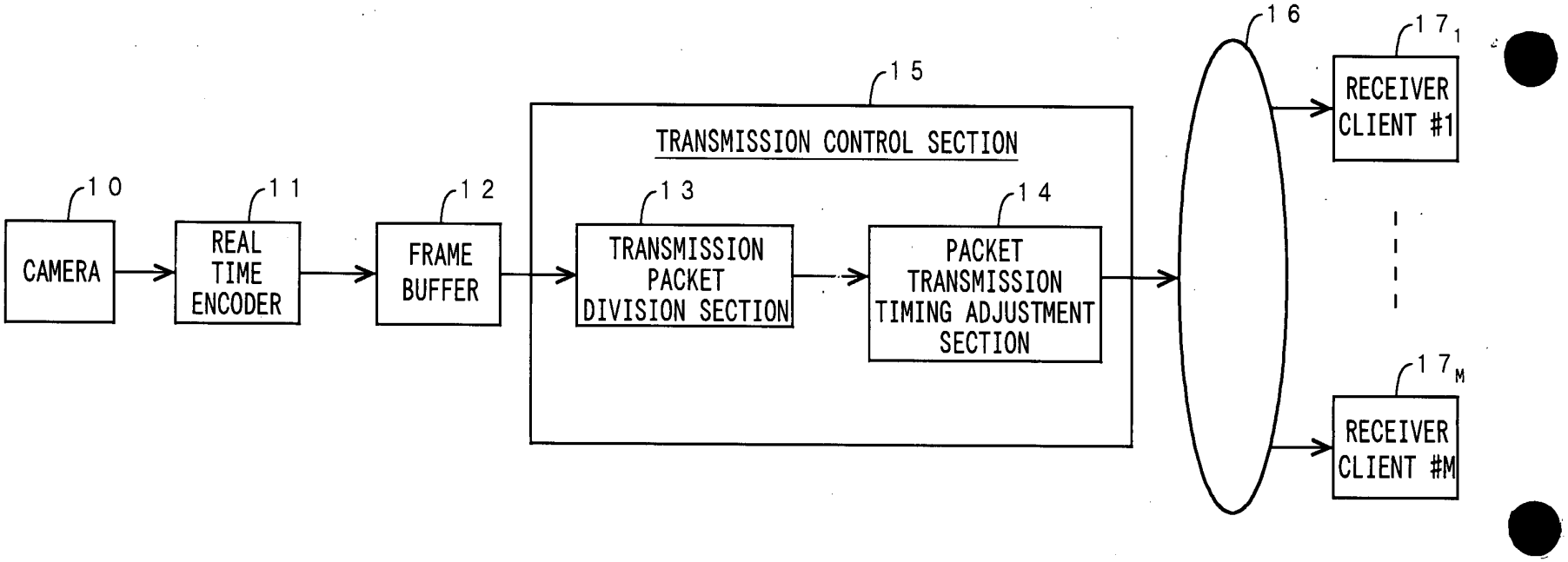

10
CAMERA
11
REAL TIME ENCODER
12
FRAME BUFFER
15
TRANSMISSION CONTROL SECTION
13
TRANSMISSION PACKET DIVISION SECTION
14
PACKET TRANSMISSION TIMING ADJUSTMENT SECTION
16
17 1
RECEIVER CLIENT #1
17 M
RECEIVER CLIENT #M

Fig. 2

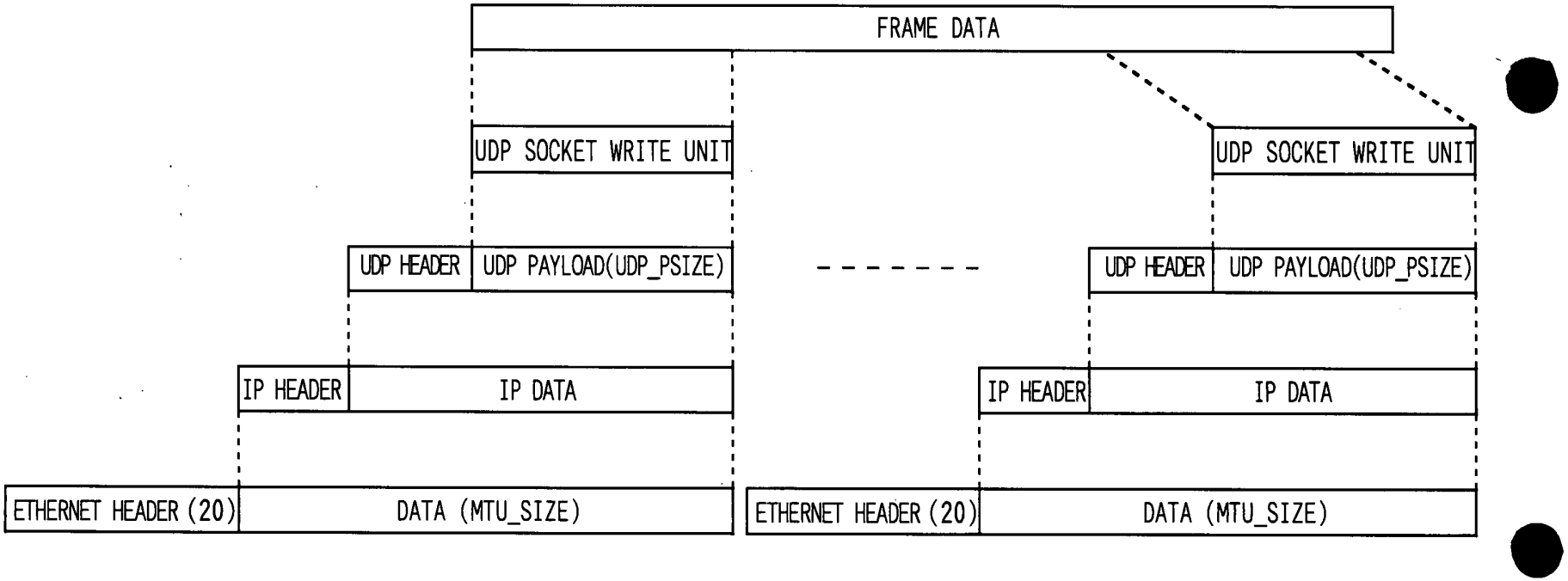

FRAME DATA
UDP SOCKET WRITE UNIT
UDP SOCKET WRITE UNIT
UDP HEADER
UDP PAYLOAD(UDP_PSIZE)
UDP HEADER
UDP PAYLOAD(UDP_PSIZE)
IP HEADER
IP DATA
IP HEADER
IP DATA
ETHERNET HEADER (20)
DATA (MTU_SIZE)
ETHERNET HEADER (20)
DATA (MTU_SIZE)

Fig. 3

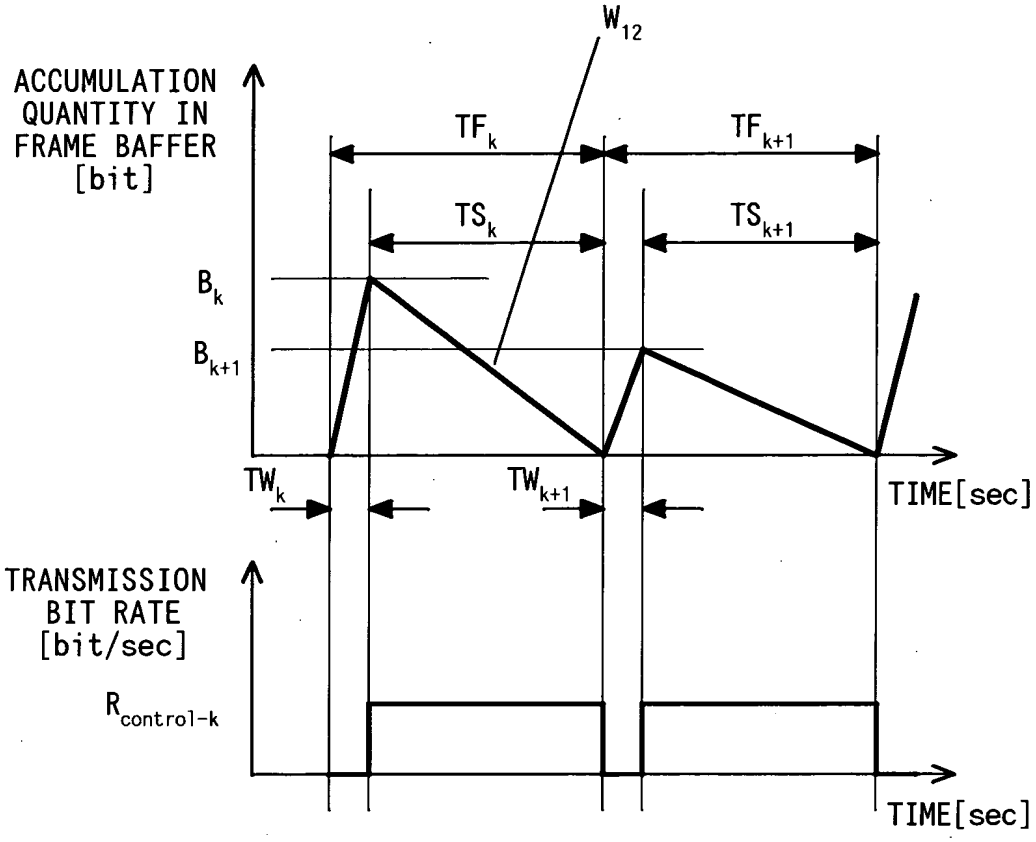

W12
ACCUMULATION QUANTITY IN FRAME BAFFER [bit]
TFk
TFk+1
TSk
TSk+1
Bk
Bk+1
TWk
TWk+1
TIME[sec]
TRANSMISSION BIT RATE [bit/sec]
Rcontrol-k
TIME[sec]

Fig. 4

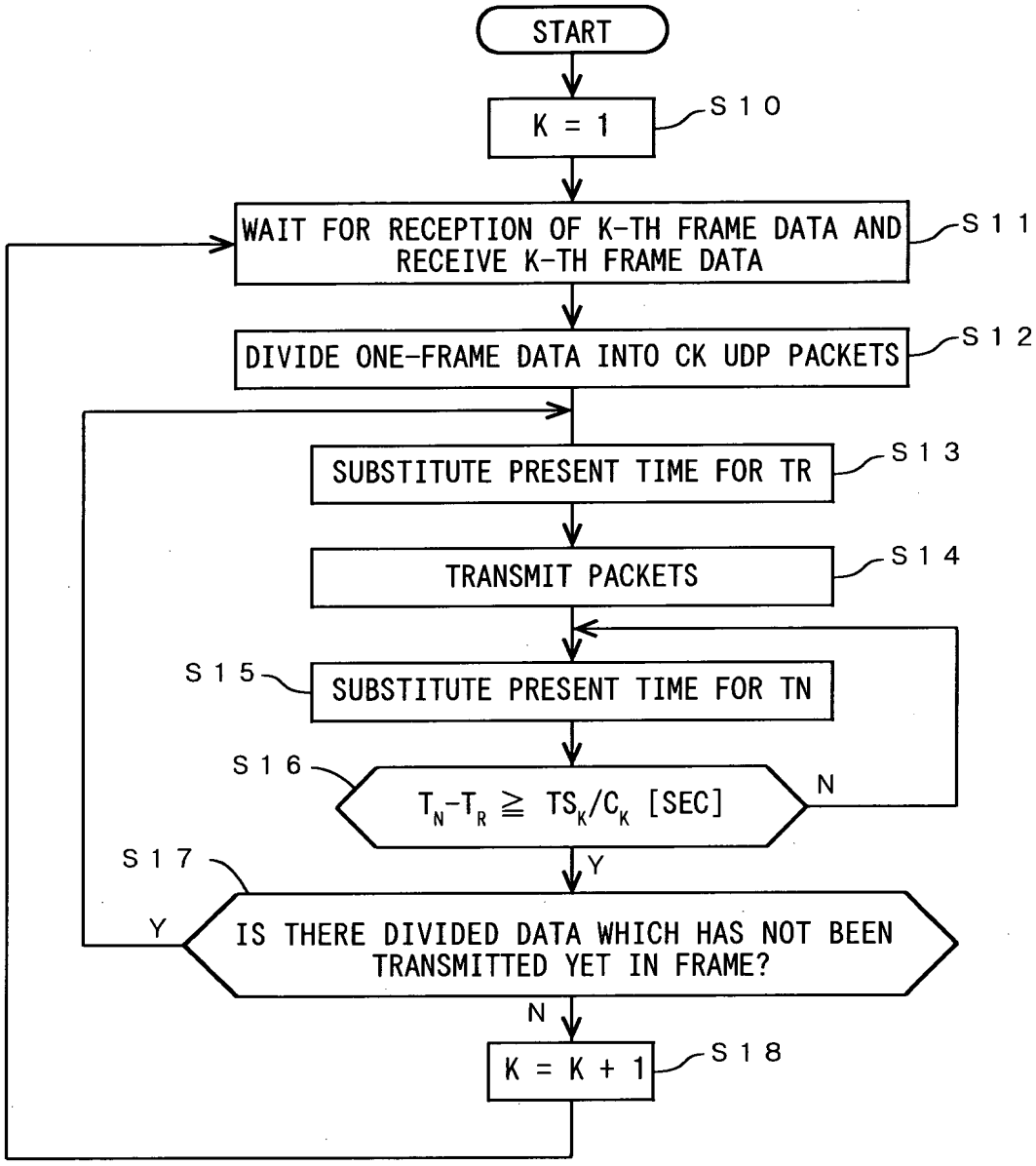

START
K = 1
S10
WAIT FOR RECEPTION OF K-TH FRAME DATA AND RECEIVE K-TH FRAME DATA
S11
DIVIDE ONE-FRAME DATA INTO CK UDP PACKETS
S12
SUBSTITUTE PRESENT TIME FOR TR
S13
TRANSMIT PACKETS
S14
S15
SUBSTITUTE PRESENT TIME FOR TN
S16
$T_N-T_R \geqq TS_K/C_K$ [SEC]
N
Y
S17
Y
IS THERE DIVIDED DATA WHICH HAS NOT BEEN TRANSMITTED YET IN FRAME?
N
K = K + 1
S18

Fig. 5

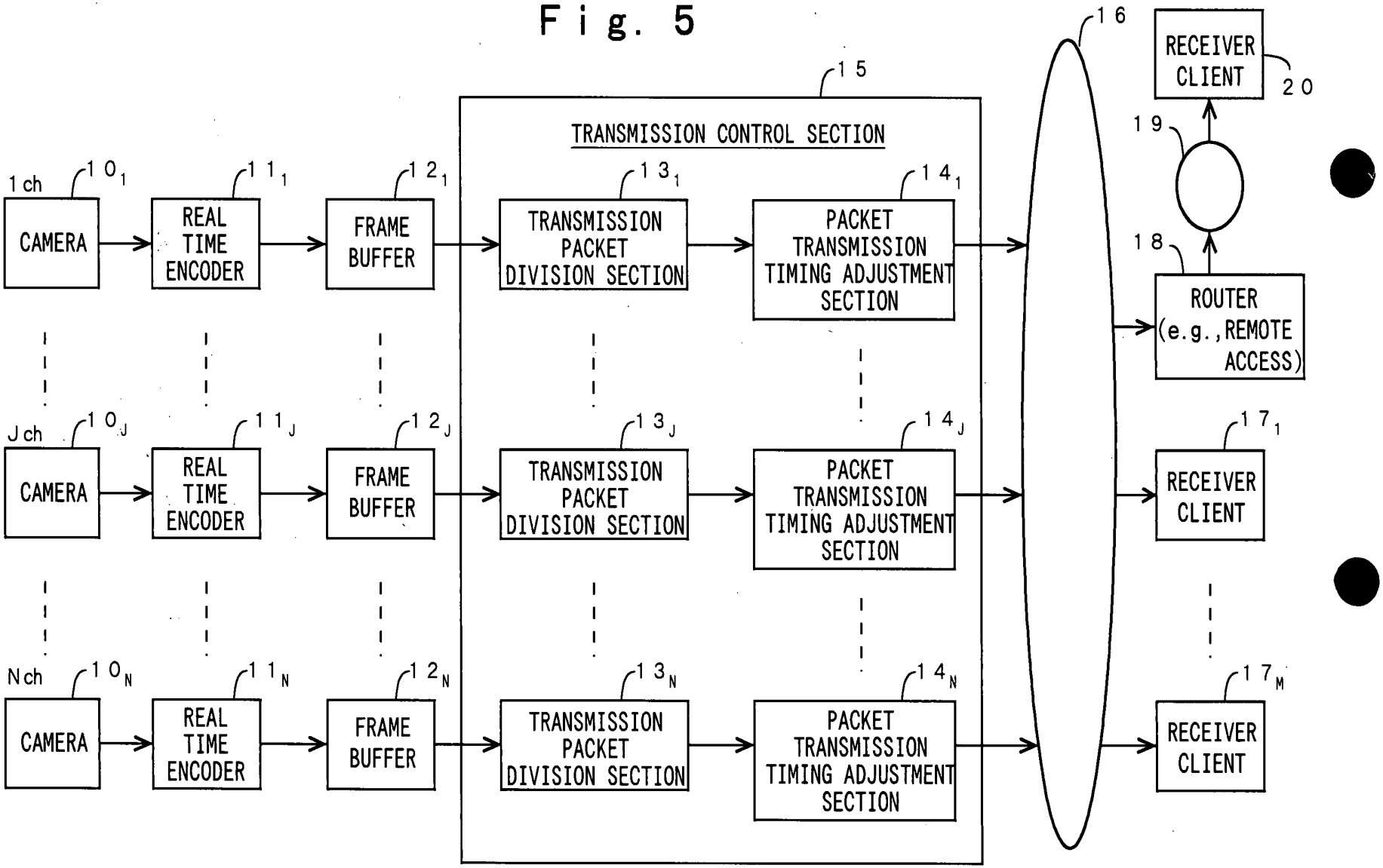

15
TRANSMISSION CONTROL SECTION
16
RECEIVER CLIENT
20
19
18
ROUTER (e.g., REMOTE ACCESS)
1ch
CAMERA
10 1
REAL TIME ENCODER
11 1
FRAME BUFFER
12 1
TRANSMISSION PACKET DIVISION SECTION
13 1
PACKET TRANSMISSION TIMING ADJUSTMENT SECTION
14 1
Jch
CAMERA
10 J
REAL TIME ENCODER
11 J
FRAME BUFFER
12 J
TRANSMISSION PACKET DIVISION SECTION
13 J
PACKET TRANSMISSION TIMING ADJUSTMENT SECTION
14 J
17 1
RECEIVER CLIENT
Nch
CAMERA
10 N
REAL TIME ENCODER
11 N
FRAME BUFFER
12 N
TRANSMISSION PACKET DIVISION SECTION
13 N
PACKET TRANSMISSION TIMING ADJUSTMENT SECTION
14 N
17 M
RECEIVER CLIENT

Fig. 6

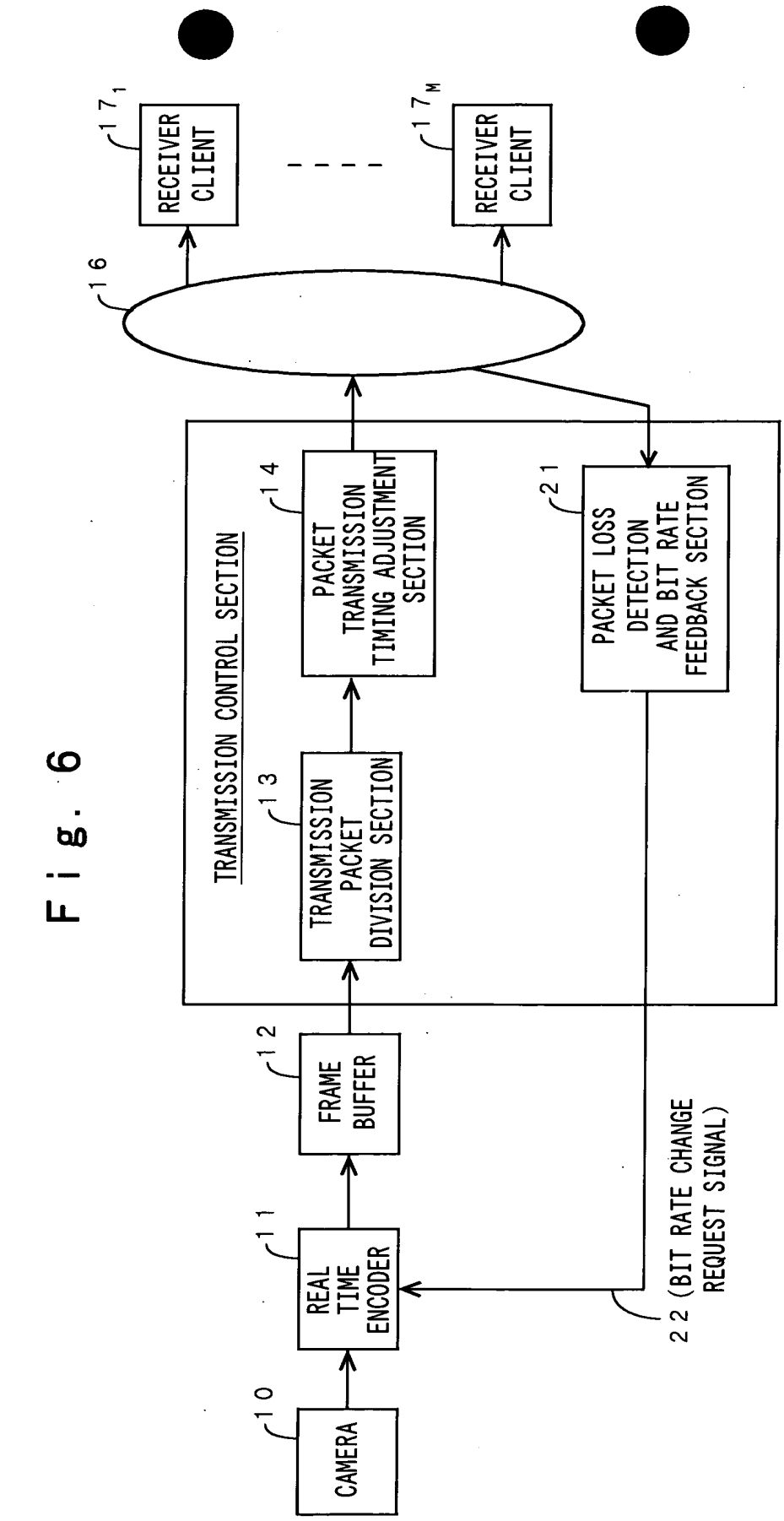

CAMERA
10
REAL TIME ENCODER
11
FRAME BUFFER
12
TRANSMISSION CONTROL SECTION
TRANSMISSION PACKET DIVISION SECTION
13
PACKET TRANSMISSION TIMING ADJUSTMENT SECTION
14
16
RECEIVER CLIENT
17 1
RECEIVER CLIENT
17 M
PACKET LOSS DETECTION AND BIT RATE FEEDBACK SECTION
21
22 (BIT RATE CHANGE REQUEST SIGNAL)

Fig. 7

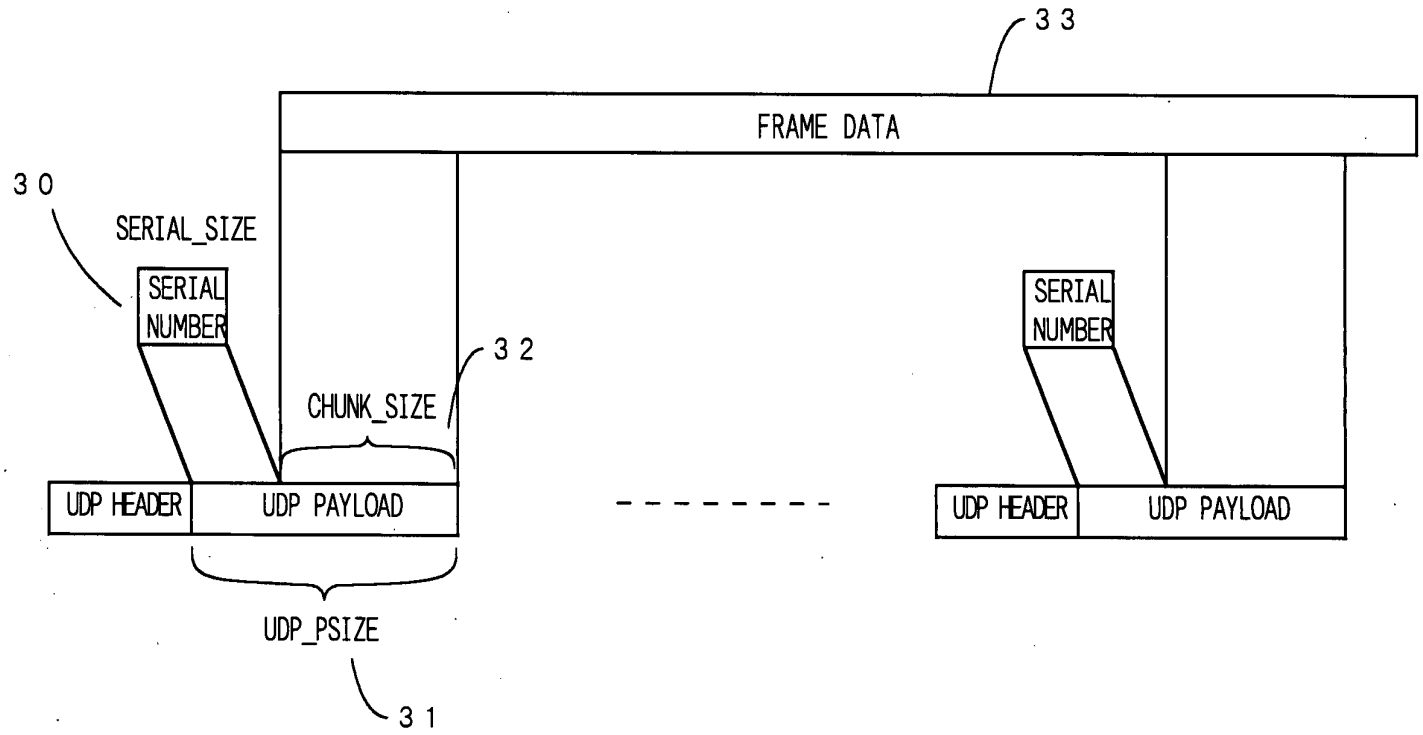

33
FRAME DATA
30
SERIAL_SIZE
SERIAL NUMBER
32
CHUNK_SIZE
UDP HEADER
UDP PAYLOAD
SERIAL NUMBER
UDP HEADER
UDP PAYLOAD
UDP_PSIZE
31

Fig. 8

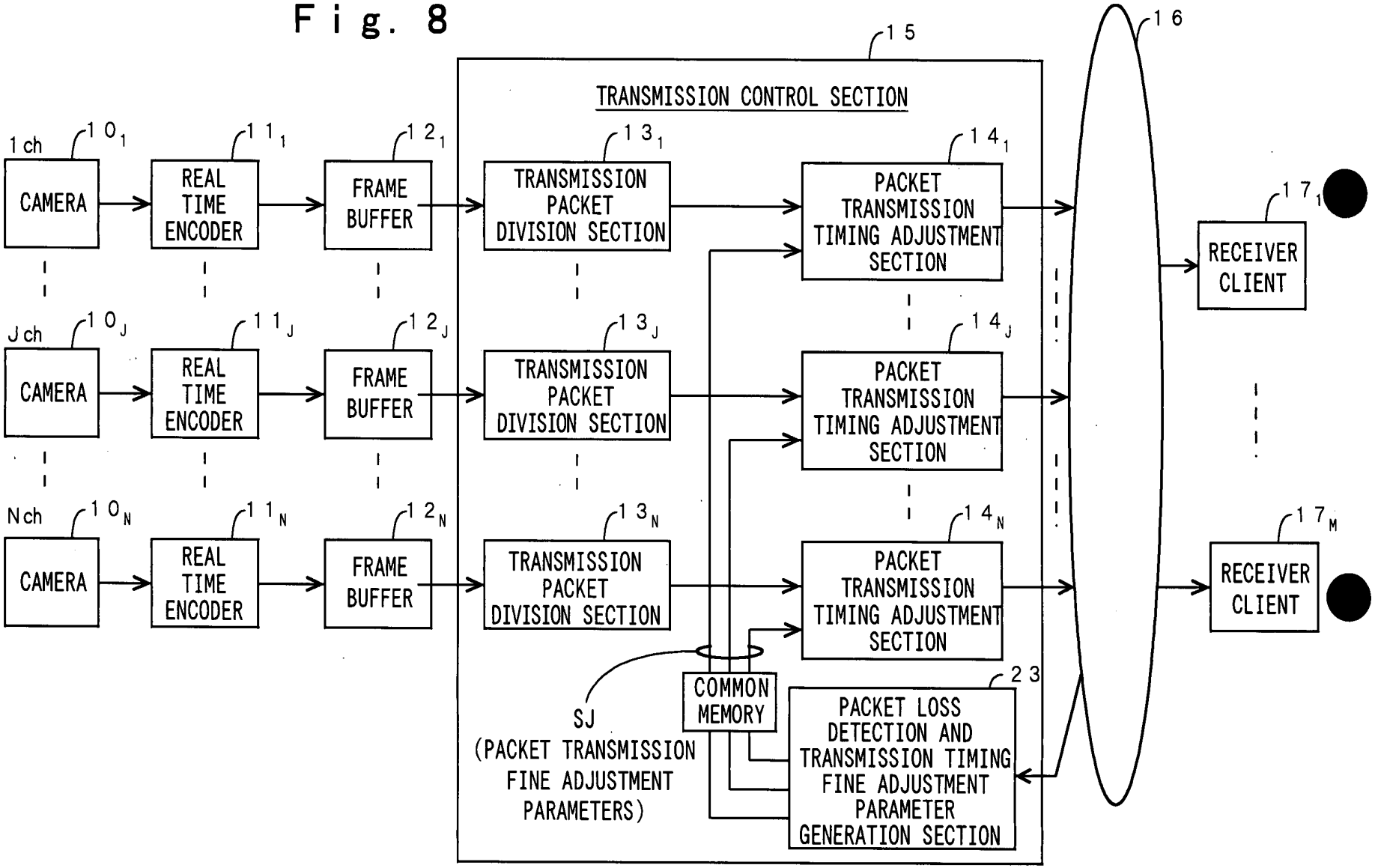

15
TRANSMISSION CONTROL SECTION
16
1ch
CAMERA
REAL TIME ENCODER
FRAME BUFFER
TRANSMISSION PACKET DIVISION SECTION
PACKET TRANSMISSION TIMING ADJUSTMENT SECTION
RECEIVER CLIENT
Jch
CAMERA
REAL TIME ENCODER
FRAME BUFFER
TRANSMISSION PACKET DIVISION SECTION
PACKET TRANSMISSION TIMING ADJUSTMENT SECTION
Nch
CAMERA
REAL TIME ENCODER
FRAME BUFFER
TRANSMISSION PACKET DIVISION SECTION
PACKET TRANSMISSION TIMING ADJUSTMENT SECTION
RECEIVER CLIENT
COMMON MEMORY
SJ
(PACKET TRANSMISSION FINE ADJUSTMENT PARAMETERS)
23
PACKET LOSS DETECTION AND TRANSMISSION TIMING FINE ADJUSTMENT PARAMETER GENERATION SECTION

Fig. 9

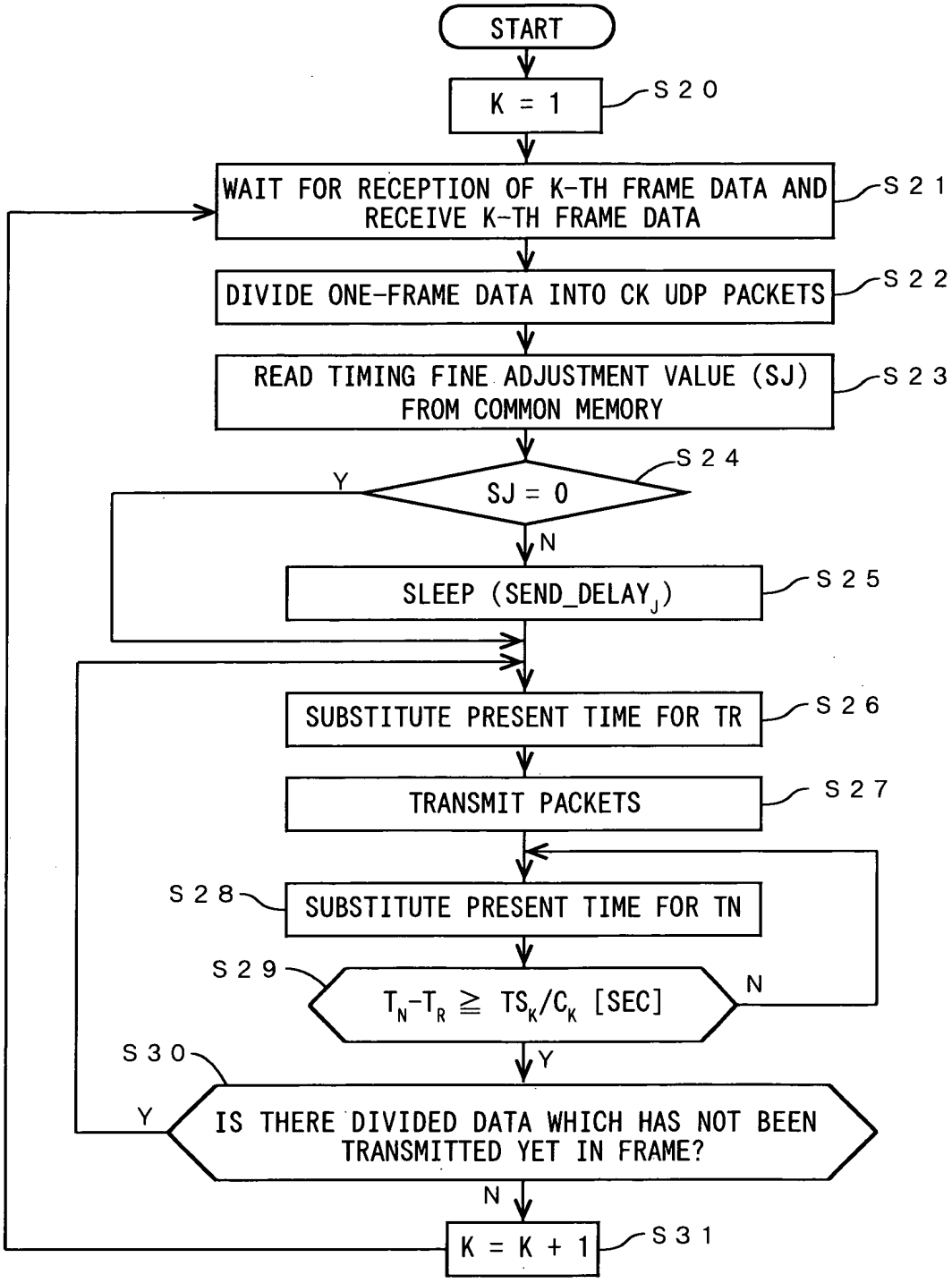

START
K = 1
S20
WAIT FOR RECEPTION OF K-TH FRAME DATA AND RECEIVE K-TH FRAME DATA
S21
DIVIDE ONE-FRAME DATA INTO CK UDP PACKETS
S22
READ TIMING FINE ADJUSTMENT VALUE (SJ) FROM COMMON MEMORY
S23
SJ = 0
S24
Y
N
SLEEP (SEND_DELAY_J)
S25
SUBSTITUTE PRESENT TIME FOR TR
S26
TRANSMIT PACKETS
S27
S28
SUBSTITUTE PRESENT TIME FOR TN
S29
T_N-T_R ≧ TS_K/C_K [SEC]
N
Y
S30
Y
IS THERE DIVIDED DATA WHICH HAS NOT BEEN TRANSMITTED YET IN FRAME?
N
K = K + 1
S31

Fig. 10

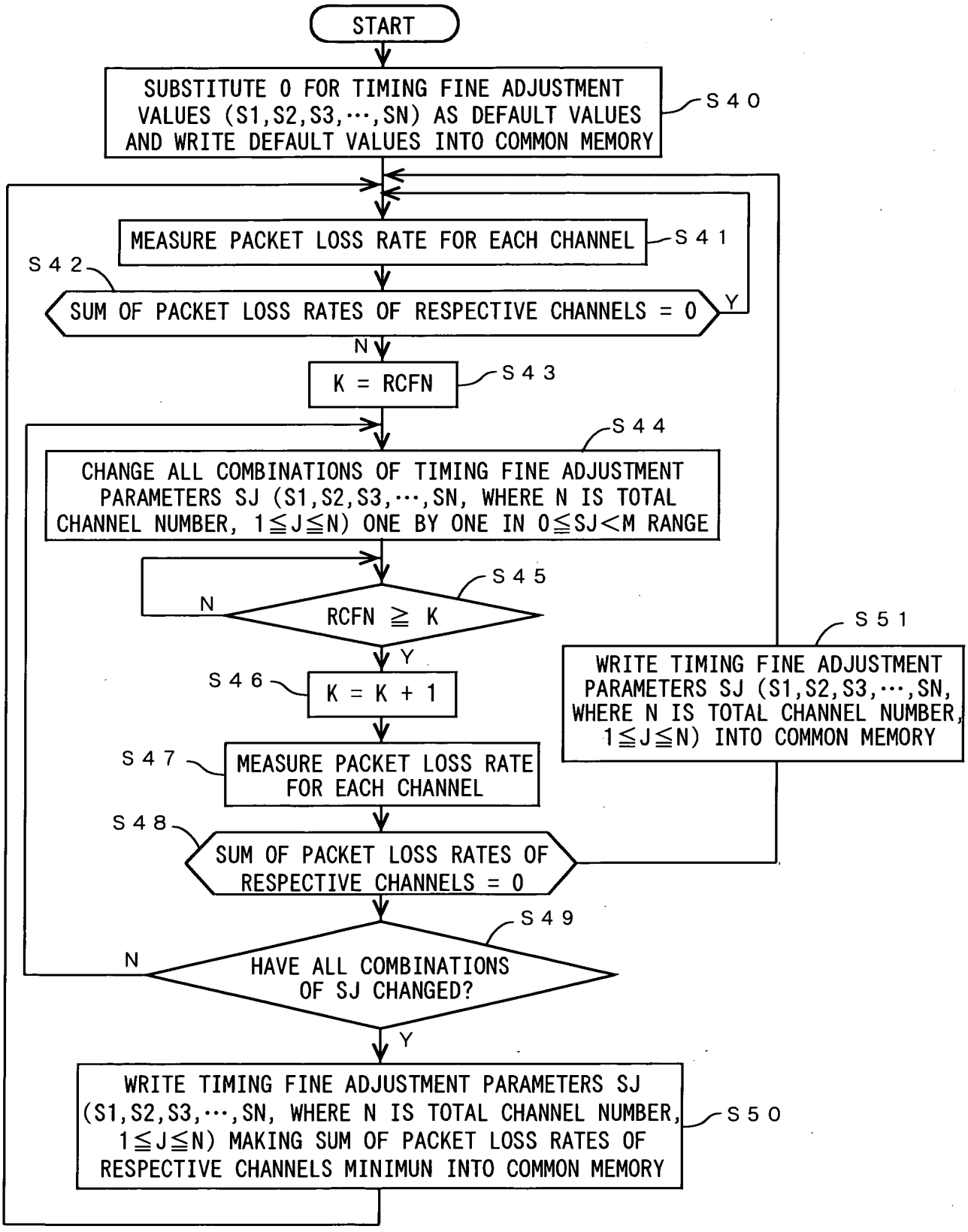

START
SUBSTITUTE 0 FOR TIMING FINE ADJUSTMENT VALUES (S1,S2,S3,…,SN) AS DEFAULT VALUES AND WRITE DEFAULT VALUES INTO COMMON MEMORY
S40
MEASURE PACKET LOSS RATE FOR EACH CHANNEL
S41
S42
SUM OF PACKET LOSS RATES OF RESPECTIVE CHANNELS = 0
Y
N
K = RCFN
S43
S44
CHANGE ALL COMBINATIONS OF TIMING FINE ADJUSTMENT PARAMETERS SJ (S1,S2,S3,…,SN, WHERE N IS TOTAL CHANNEL NUMBER, 1≦J≦N) ONE BY ONE IN 0≦SJ<M RANGE
S45
N
RCFN ≧ K
Y
S46
K = K + 1
S47
MEASURE PACKET LOSS RATE FOR EACH CHANNEL
S48
SUM OF PACKET LOSS RATES OF RESPECTIVE CHANNELS = 0
S49
N
HAVE ALL COMBINATIONS OF SJ CHANGED?
Y
WRITE TIMING FINE ADJUSTMENT PARAMETERS SJ (S1,S2,S3,…,SN, WHERE N IS TOTAL CHANNEL NUMBER, 1≦J≦N) MAKING SUM OF PACKET LOSS RATES OF RESPECTIVE CHANNELS MINIMUN INTO COMMON MEMORY
S50
S51
WRITE TIMING FINE ADJUSTMENT PARAMETERS SJ (S1,S2,S3,…,SN, WHERE N IS TOTAL CHANNEL NUMBER, 1≦J≦N) INTO COMMON MEMORY

Fig. 11

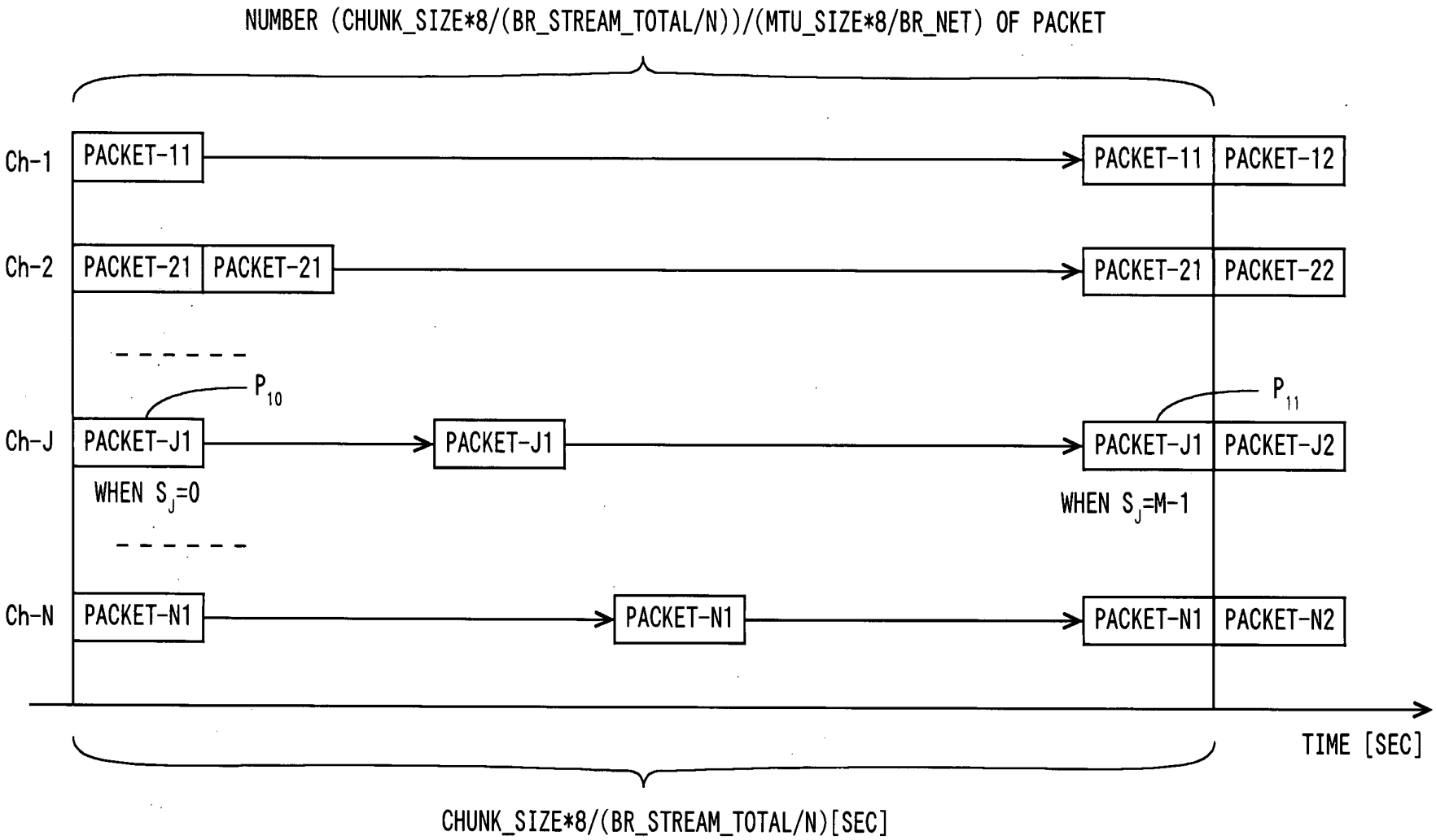

NUMBER (CHUNK_SIZE*8/(BR_STREAM_TOTAL/N))/(MTU_SIZE*8/BR_NET) OF PACKET
Ch-1
PACKET-11
PACKET-11
PACKET-12
Ch-2
PACKET-21
PACKET-21
PACKET-21
PACKET-22
P10
P11
Ch-J
PACKET-J1
PACKET-J1
PACKET-J1
PACKET-J2
WHEN SJ=0
WHEN SJ=M-1
Ch-N
PACKET-N1
PACKET-N1
PACKET-N1
PACKET-N2
TIME [SEC]
CHUNK_SIZE*8/(BR_STREAM_TOTAL/N)[SEC]

Fig. 12

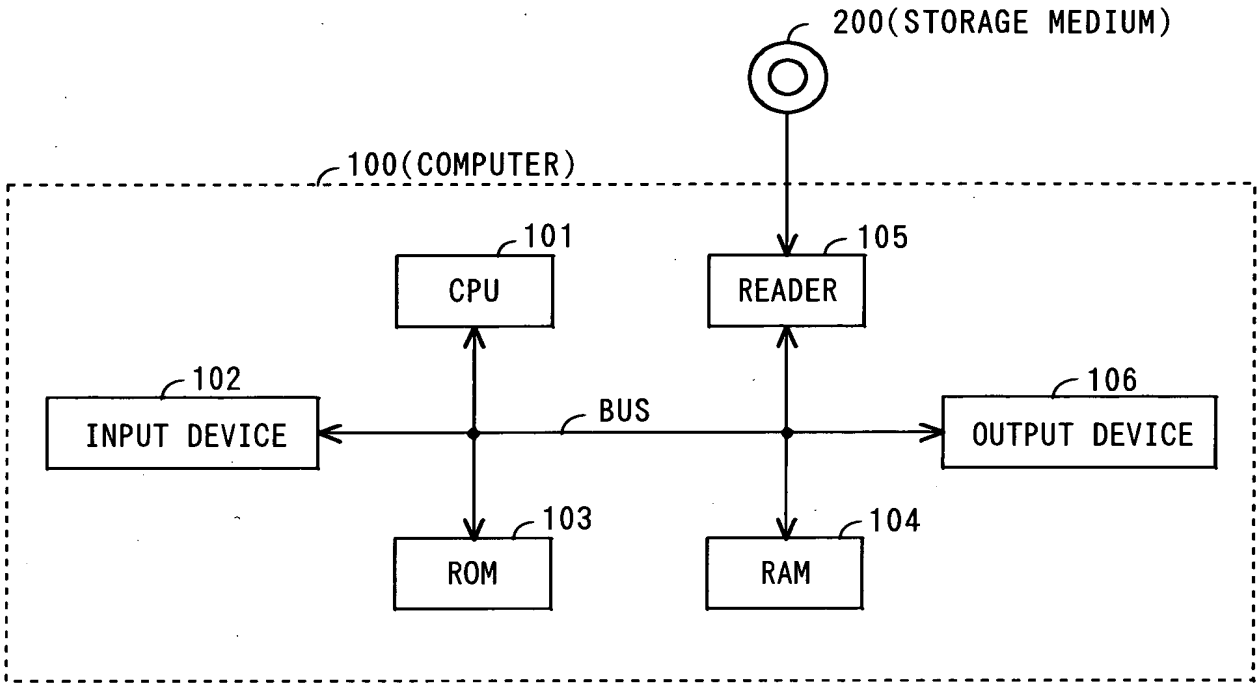

200(STORAGE MEDIUM)
100(COMPUTER)
101
CPU
105
READER
102
INPUT DEVICE
BUS
106
OUTPUT DEVICE
103
ROM
104
RAM

Fig. 13

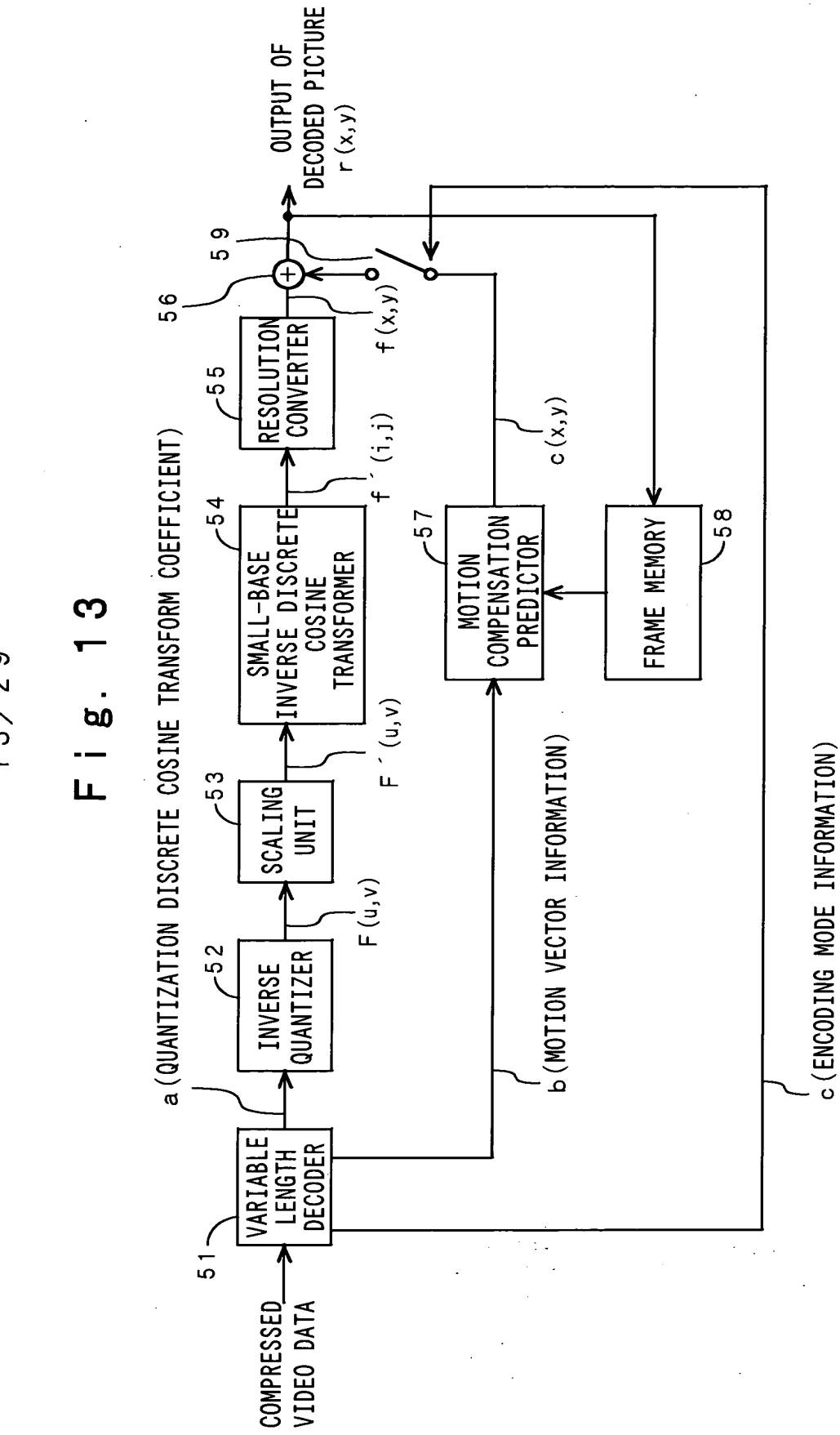

COMPRESSED VIDEO DATA
51
VARIABLE LENGTH DECODER
a (QUANTIZATION DISCRETE COSINE TRANSFORM COEFFICIENT)
52
INVERSE QUANTIZER
F (u,v)
53
SCALING UNIT
F´(u,v)
54
SMALL-BASE INVERSE DISCRETE COSINE TRANSFORMER
f´(i,j)
55
RESOLUTION CONVERTER
56
f(x,y)
59
OUTPUT OF DECODED PICTURE
r(x,y)
b (MOTION VECTOR INFORMATION)
57
MOTION COMPENSATION PREDICTOR
c(x,y)
58
FRAME MEMORY
c (ENCODING MODE INFORMATION)

Fig. 14

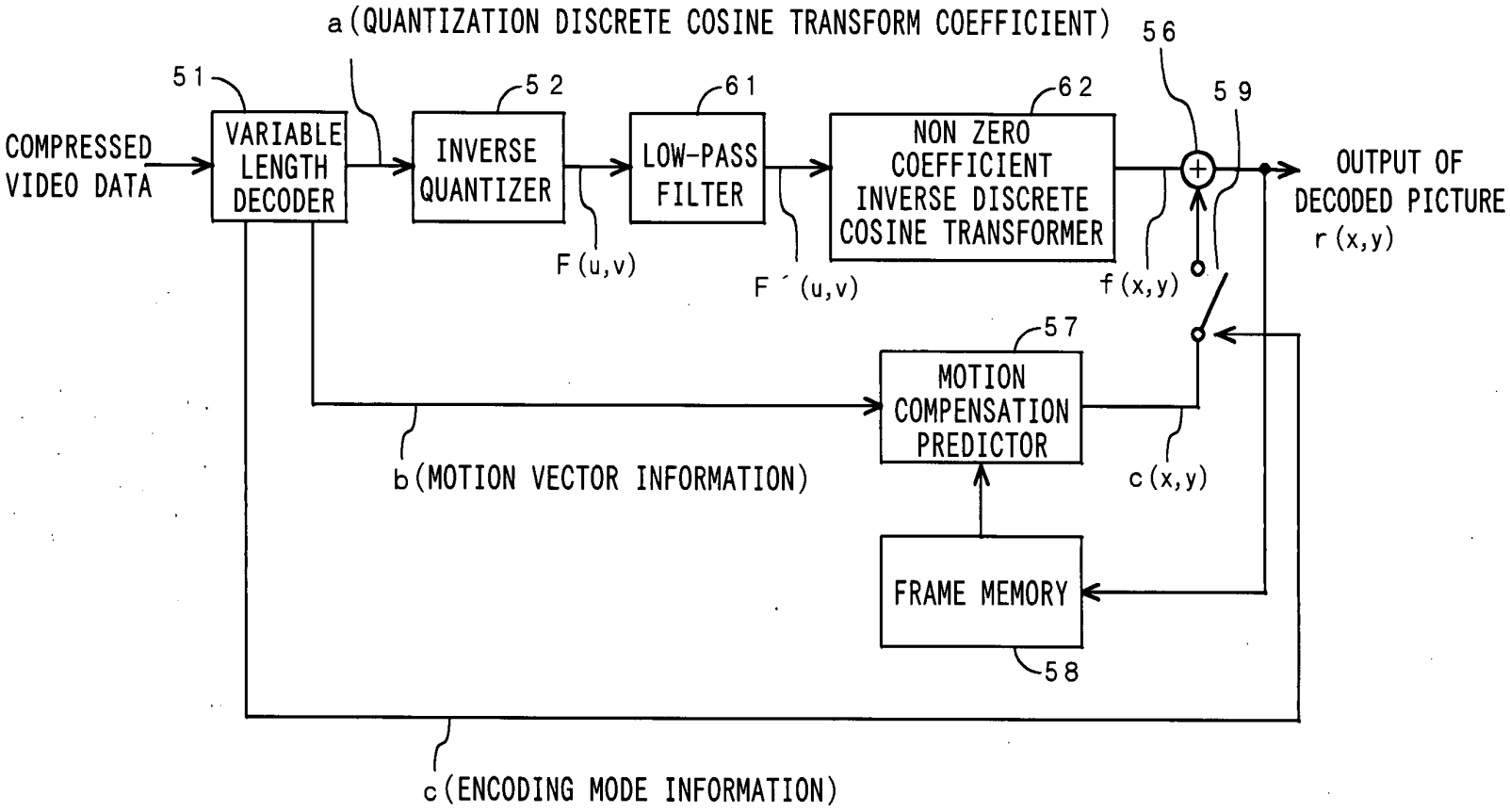

a (QUANTIZATION DISCRETE COSINE TRANSFORM COEFFICIENT)
51
52
61
62
56
59
COMPRESSED VIDEO DATA
VARIABLE LENGTH DECODER
INVERSE QUANTIZER
LOW-PASS FILTER
NON ZERO COEFFICIENT INVERSE DISCRETE COSINE TRANSFORMER
OUTPUT OF DECODED PICTURE
r (x,y)
F (u,v)
F´ (u,v)
f (x,y)
57
MOTION COMPENSATION PREDICTOR
b (MOTION VECTOR INFORMATION)
c (x,y)
FRAME MEMORY
58
c (ENCODING MODE INFORMATION)

Fig. 15 PRIOR ART

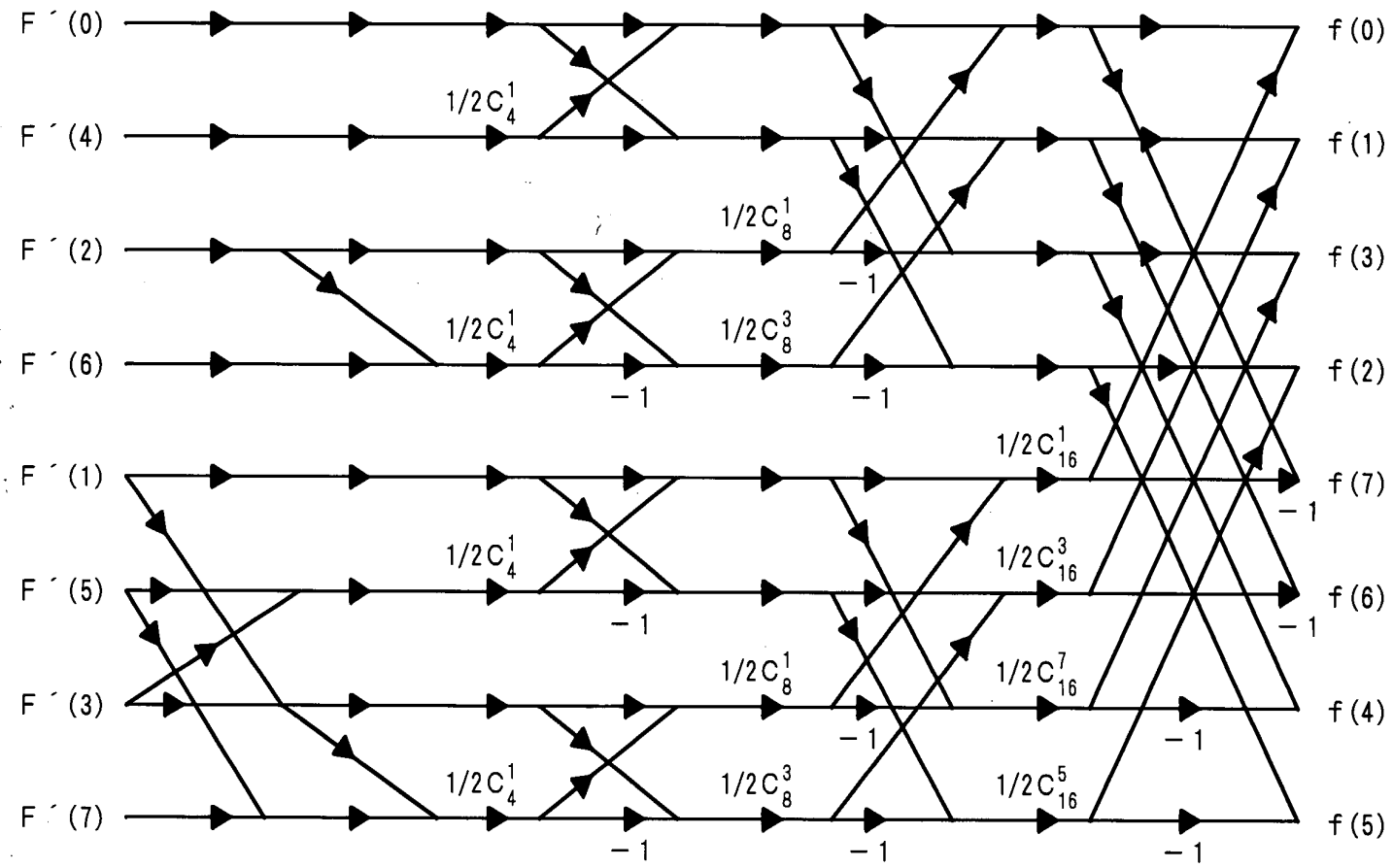


Fig. 16

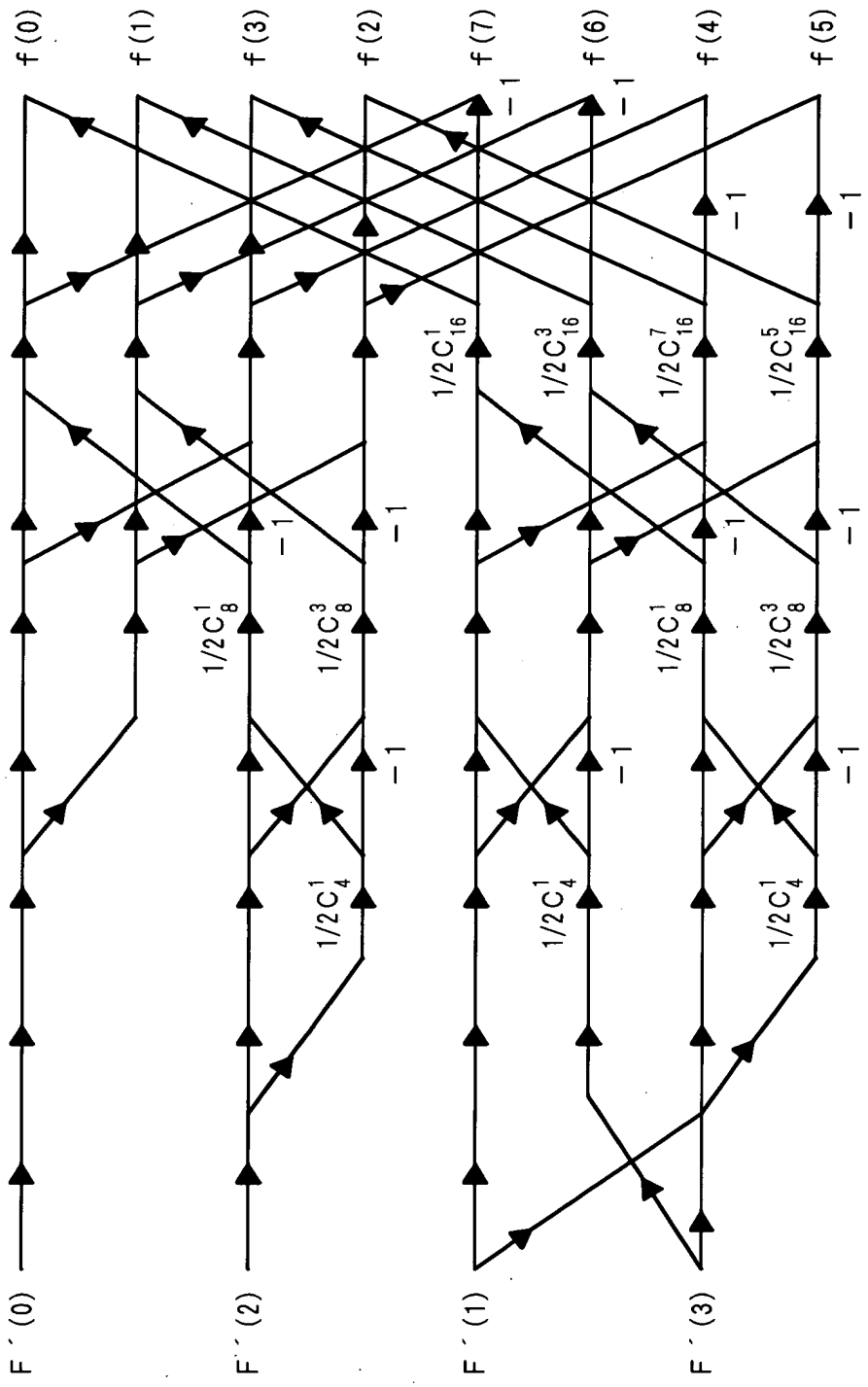

F´(0)
F´(2)
F´(1)
F´(3)
f(0)
f(1)
f(3)
f(2)
f(7)
f(6)
f(4)
f(5)
1/2C¹₄
1/2C¹₈
1/2C³₈
1/2C¹₁₆
1/2C³₁₆
1/2C⁷₁₆
1/2C⁵₁₆
−1

Fig. 17

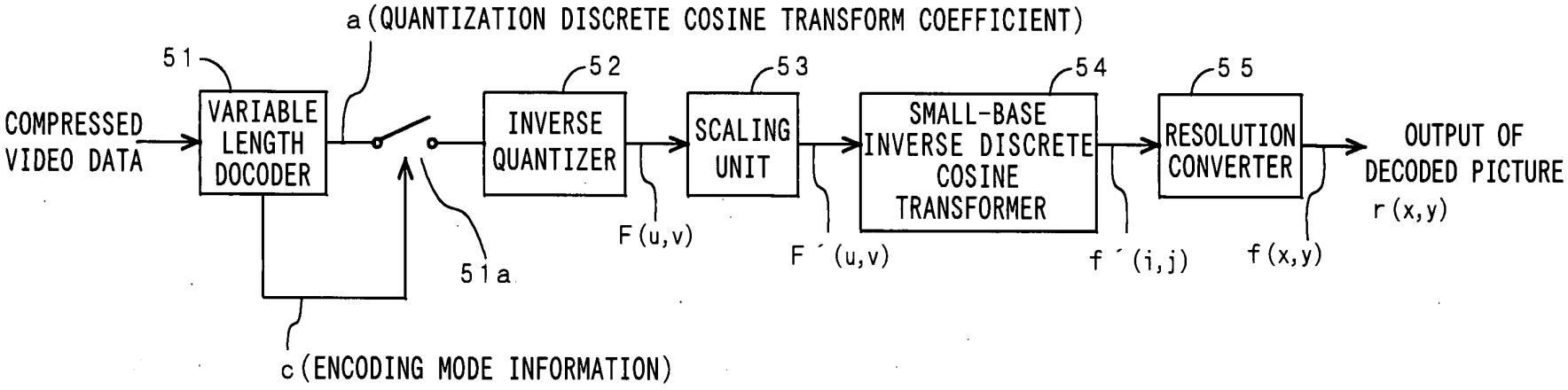

a (QUANTIZATION DISCRETE COSINE TRANSFORM COEFFICIENT)
51
52
53
54
55
COMPRESSED VIDEO DATA
VARIABLE LENGTH DOCODER
INVERSE QUANTIZER
SCALING UNIT
SMALL-BASE INVERSE DISCRETE COSINE TRANSFORMER
RESOLUTION CONVERTER
OUTPUT OF DECODED PICTURE
r (x,y)
F (u,v)
F´(u,v)
f´(i,j)
f (x,y)
51a
c (ENCODING MODE INFORMATION)

Fig. 18

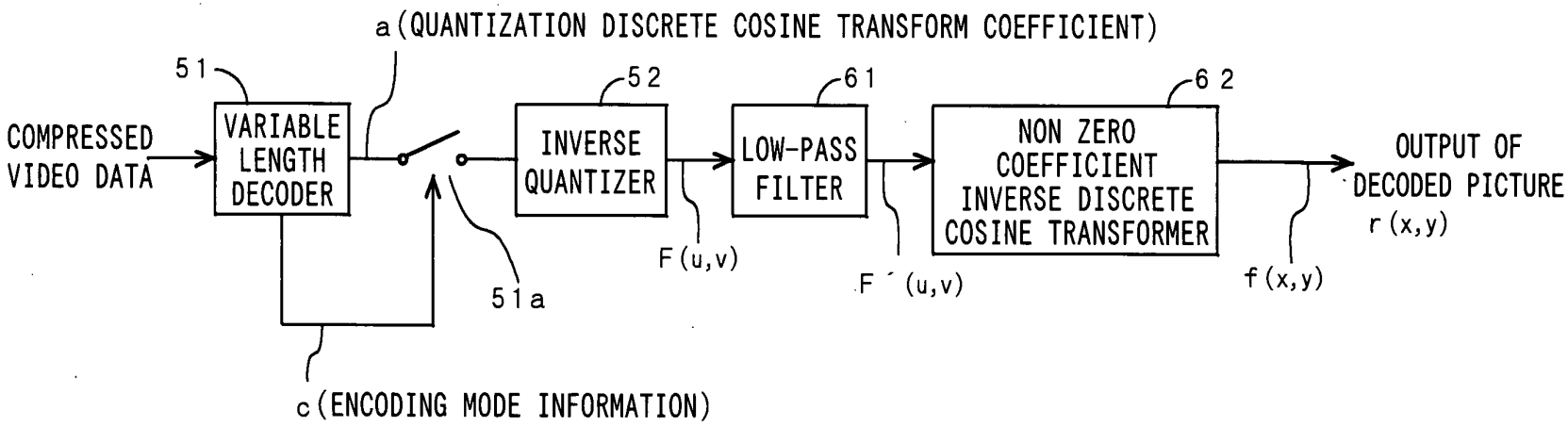

a (QUANTIZATION DISCRETE COSINE TRANSFORM COEFFICIENT)
51
52
61
62
COMPRESSED VIDEO DATA
VARIABLE LENGTH DECODER
INVERSE QUANTIZER
LOW-PASS FILTER
NON ZERO COEFFICIENT INVERSE DISCRETE COSINE TRANSFORMER
OUTPUT OF DECODED PICTURE
r (x,y)
F (u,v)
F´ (u,v)
f (x,y)
51a
c (ENCODING MODE INFORMATION)

Fig. 19

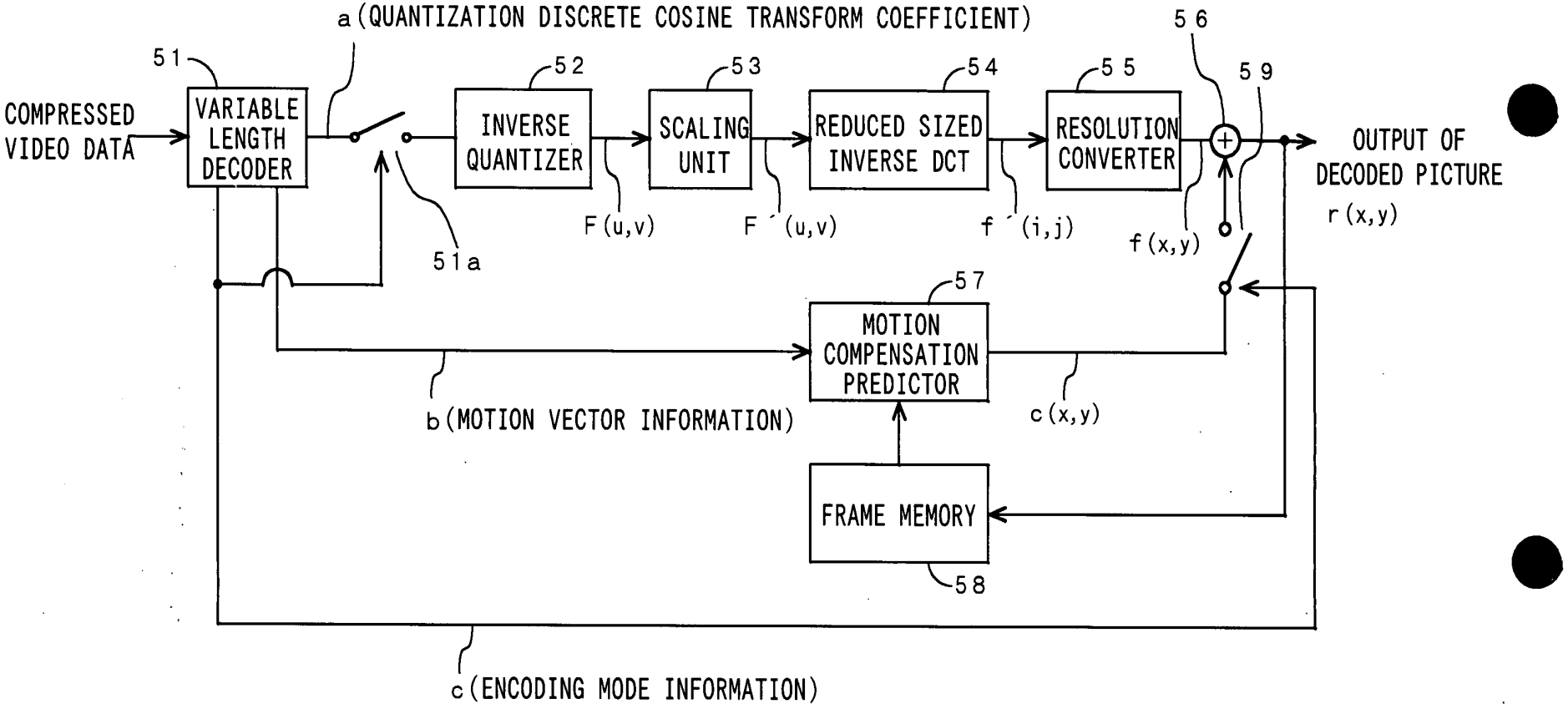

a (QUANTIZATION DISCRETE COSINE TRANSFORM COEFFICIENT)
51
52
53
54
55
56
59
COMPRESSED VIDEO DATA
VARIABLE LENGTH DECODER
INVERSE QUANTIZER
SCALING UNIT
REDUCED SIZED INVERSE DCT
RESOLUTION CONVERTER
OUTPUT OF DECODED PICTURE
r (x,y)
F (u,v)
F´(u,v)
f´(i,j)
f (x,y)
51a
57
MOTION COMPENSATION PREDICTOR
b (MOTION VECTOR INFORMATION)
c (x,y)
FRAME MEMORY
58
c (ENCODING MODE INFORMATION)

Fig. 20

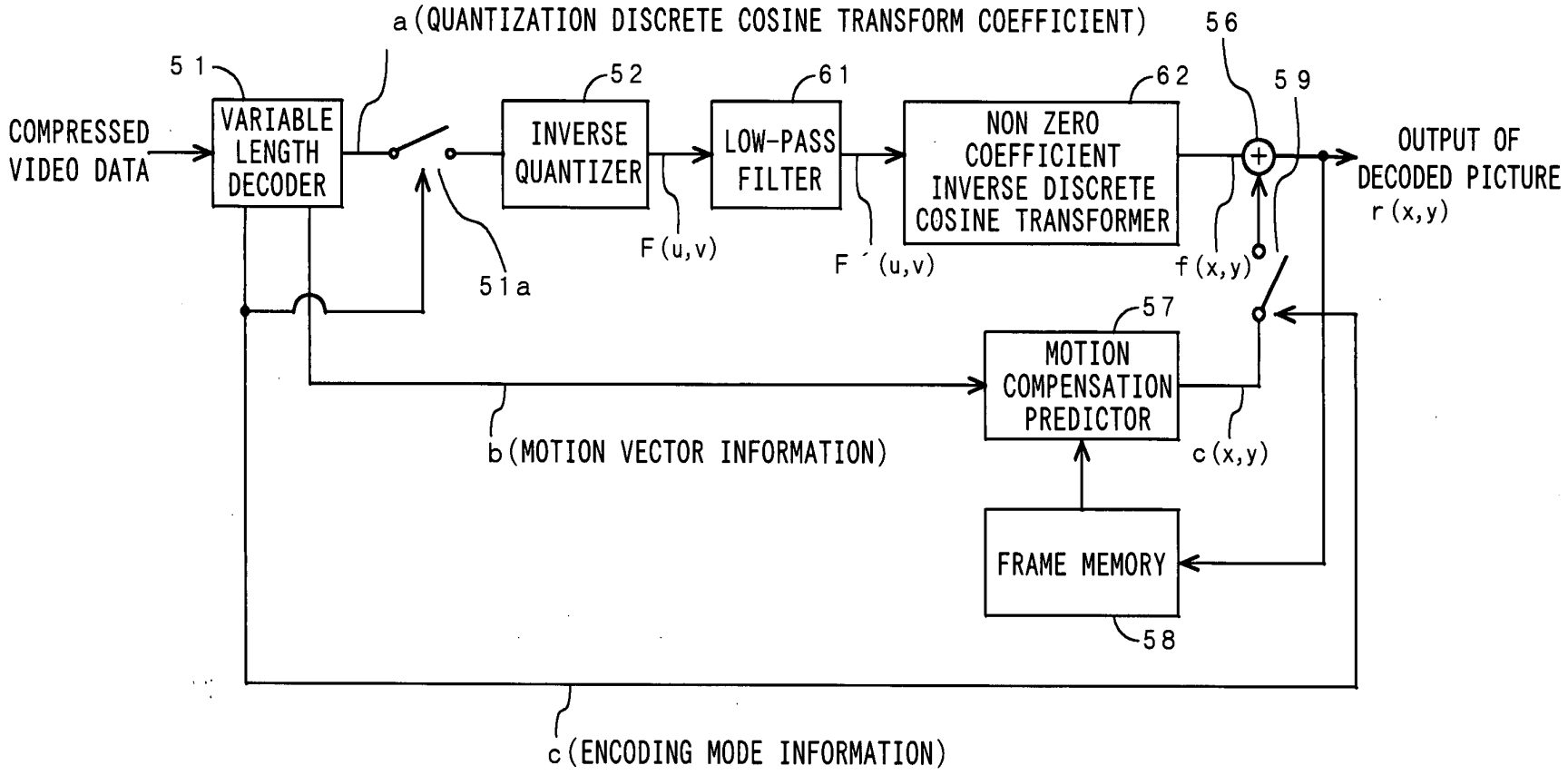

a (QUANTIZATION DISCRETE COSINE TRANSFORM COEFFICIENT)
56
51
52
61
62
59
COMPRESSED VIDEO DATA
VARIABLE LENGTH DECODER
INVERSE QUANTIZER
LOW-PASS FILTER
NON ZERO COEFFICIENT INVERSE DISCRETE COSINE TRANSFORMER
OUTPUT OF DECODED PICTURE
r (x,y)
51a
F (u,v)
F ' (u,v)
f (x,y)
57
MOTION COMPENSATION PREDICTOR
b (MOTION VECTOR INFORMATION)
c (x,y)
FRAME MEMORY
58
c (ENCODING MODE INFORMATION)

Fig. 21

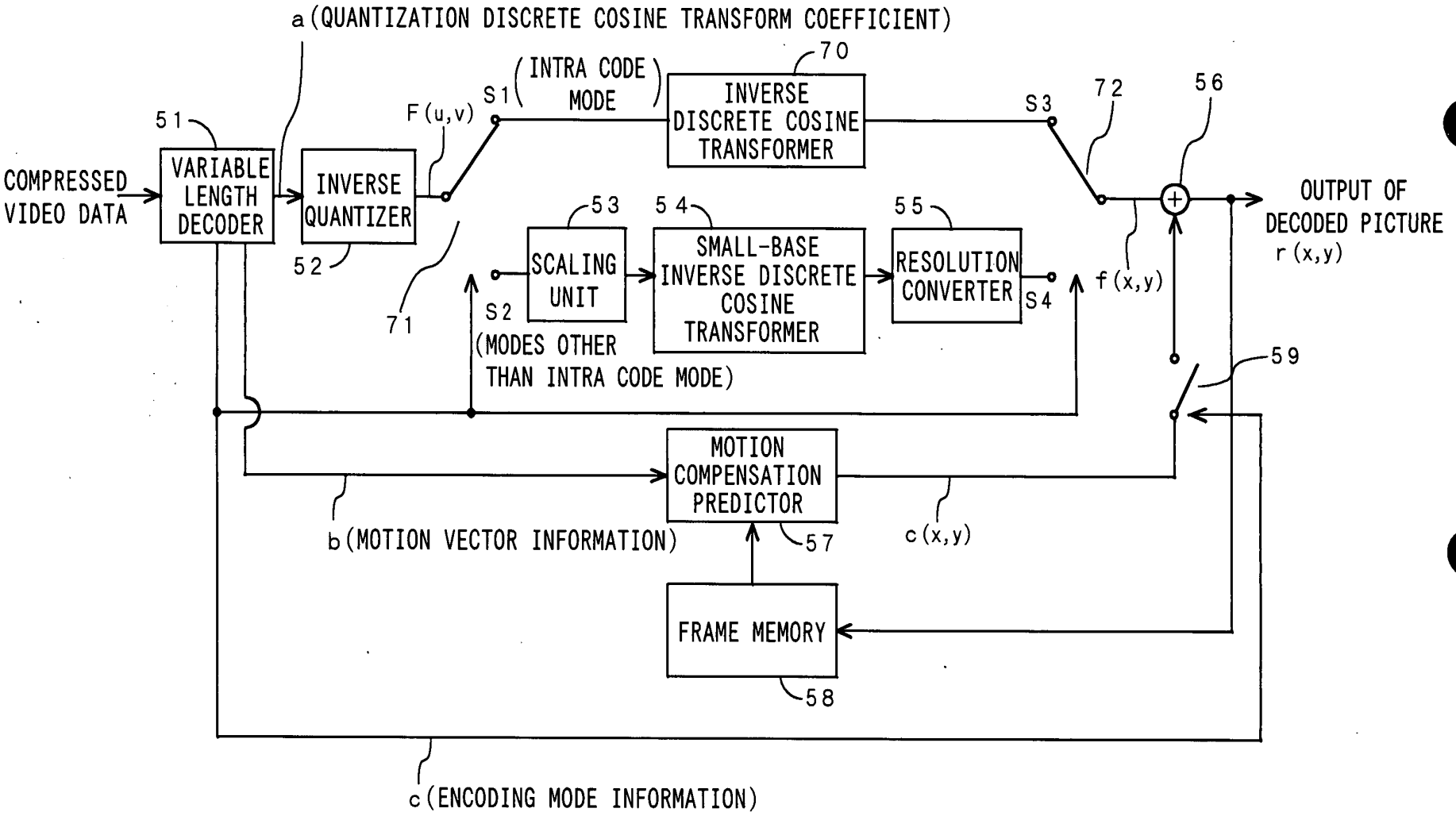

a (QUANTIZATION DISCRETE COSINE TRANSFORM COEFFICIENT)
COMPRESSED VIDEO DATA
VARIABLE LENGTH DECODER
51
INVERSE QUANTIZER
52
F(u,v)
S1
(INTRA CODE MODE)
INVERSE DISCRETE COSINE TRANSFORMER
70
S3
72
56
OUTPUT OF DECODED PICTURE
r(x,y)
f(x,y)
71
S2
(MODES OTHER THAN INTRA CODE MODE)
SCALING UNIT
53
SMALL-BASE INVERSE DISCRETE COSINE TRANSFORMER
54
RESOLUTION CONVERTER
55
S4
59
MOTION COMPENSATION PREDICTOR
57
b (MOTION VECTOR INFORMATION)
c(x,y)
FRAME MEMORY
58
c (ENCODING MODE INFORMATION)

Fig. 22

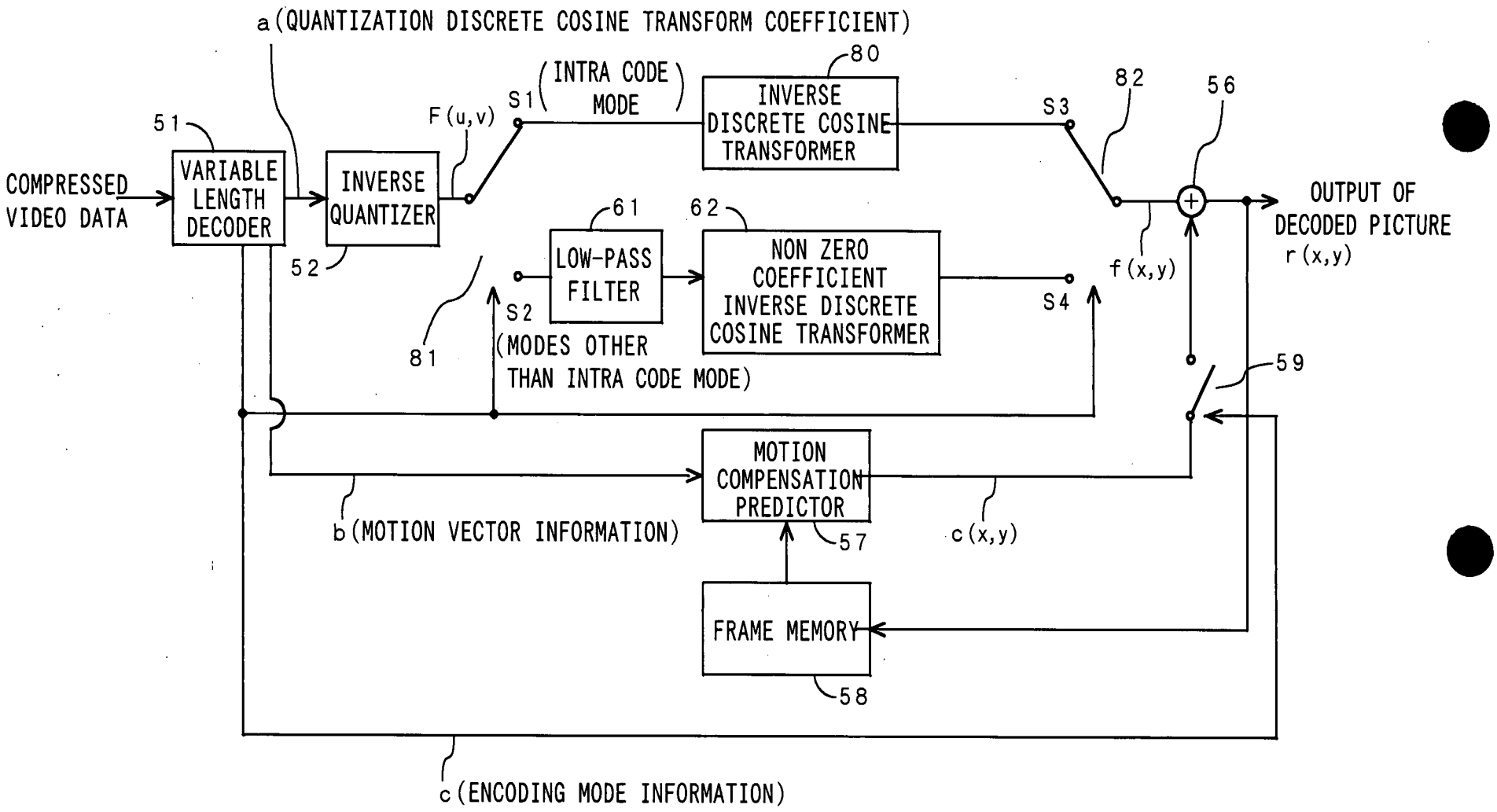

a (QUANTIZATION DISCRETE COSINE TRANSFORM COEFFICIENT)
COMPRESSED VIDEO DATA
51
VARIABLE LENGTH DECODER
INVERSE QUANTIZER
52
F(u,v)
S1
(INTRA CODE MODE)
80
INVERSE DISCRETE COSINE TRANSFORMER
S3
82
56
OUTPUT OF DECODED PICTURE
r(x,y)
f(x,y)
61
62
LOW-PASS FILTER
NON ZERO COEFFICIENT INVERSE DISCRETE COSINE TRANSFORMER
S4
S2
81
(MODES OTHER THAN INTRA CODE MODE)
59
MOTION COMPENSATION PREDICTOR
57
b (MOTION VECTOR INFORMATION)
c(x,y)
FRAME MEMORY
58
c (ENCODING MODE INFORMATION)

Fig. 23

$$F'(u,v)=\frac{F(u,v)}{\left(2^{p_1/2}\cos\frac{u\pi}{4N/2}\cdot\cos\frac{u\pi}{4N/2^2}\cdots\cos\frac{u\pi}{4N/2^{p_1}}\right)\left(2^{p_2/2}\cos\frac{v\pi}{4N/2}\cdot\cos\frac{v\pi}{4N/2^2}\cdots\cos\frac{v\pi}{4N/2^{p_2}}\right)}\quad\cdots(15)$$

$$f(x,y)=\frac{2}{N}\sum_{u=0}^{b_1-1}\sum_{v=0}^{b_2-1}C(u)C(v)F(u,v)\cos\frac{(2x+1)u\pi}{2N}\cos\frac{(2y+1)v\pi}{2N}\quad\cdots(29)$$

$$C(p)=\begin{cases}1/\sqrt{2} & p=0\\ 1 & p\neq 0\end{cases}\quad\cdots(30)$$

$$C_a^b=\cos\left(\frac{a\pi}{b}\right)\quad\cdots(31)$$

Fig. 24A

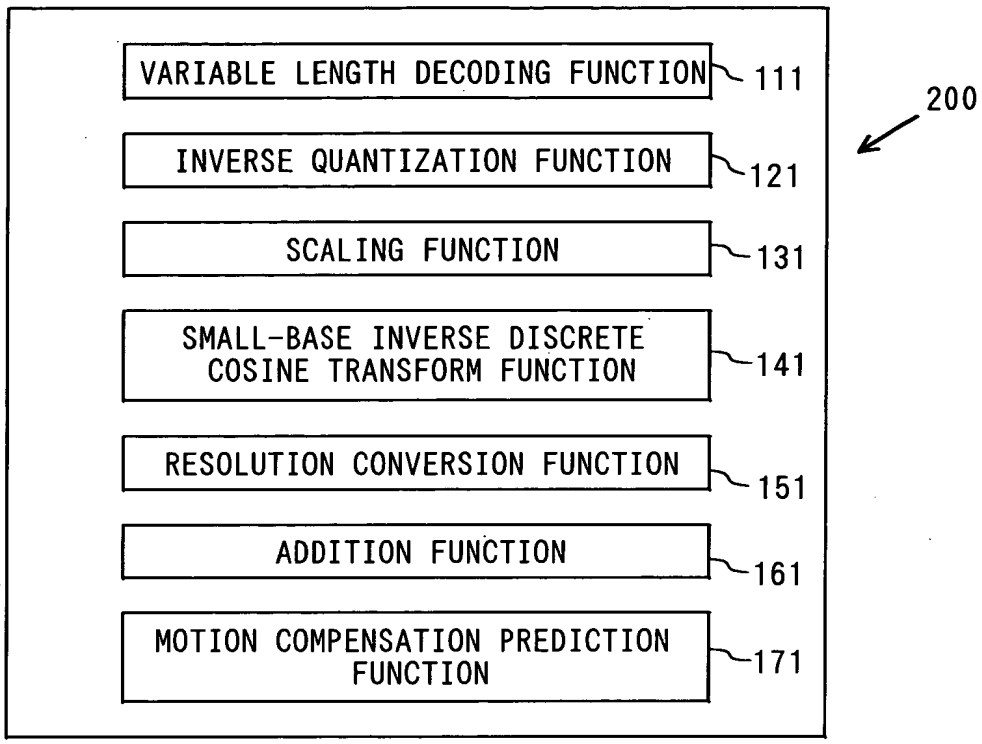


Fig. 24B

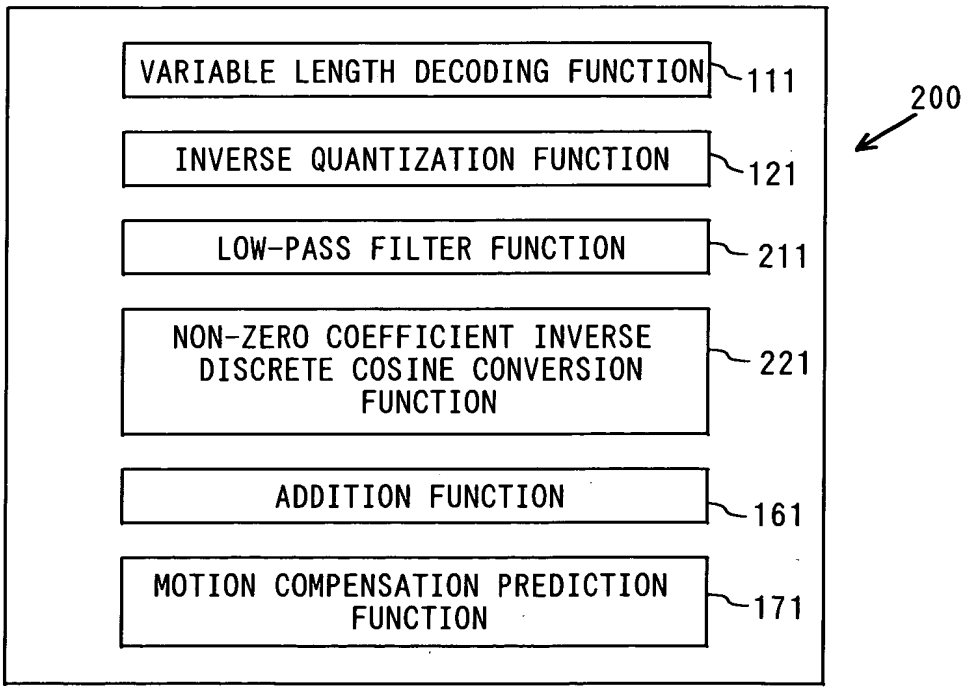


Fig. 25

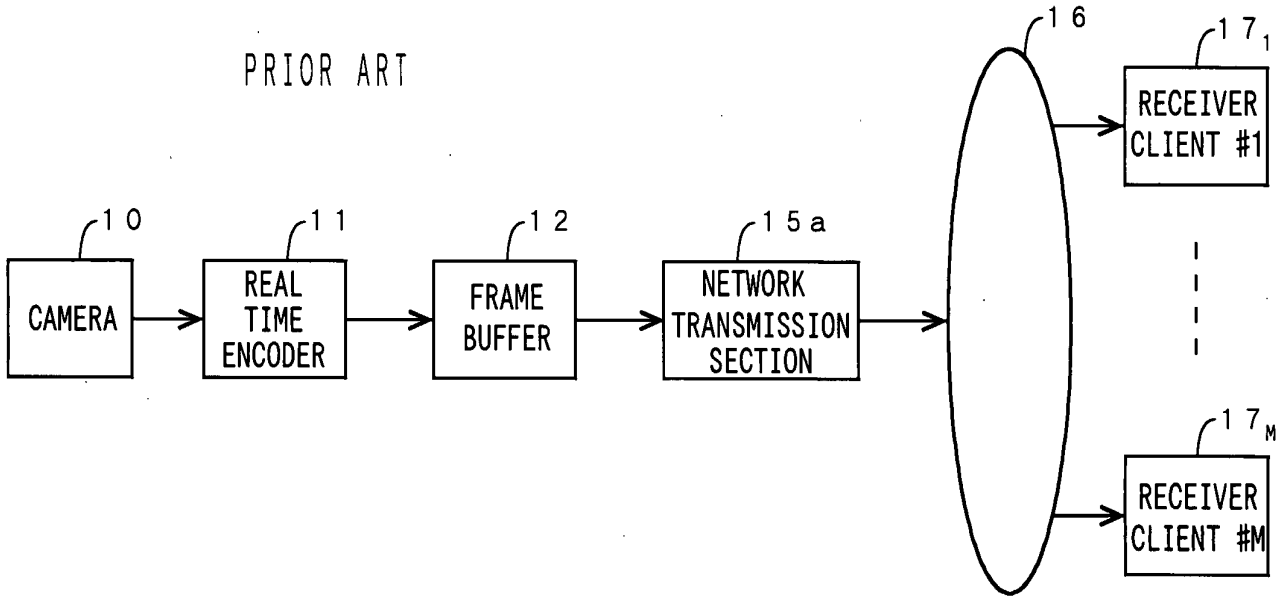
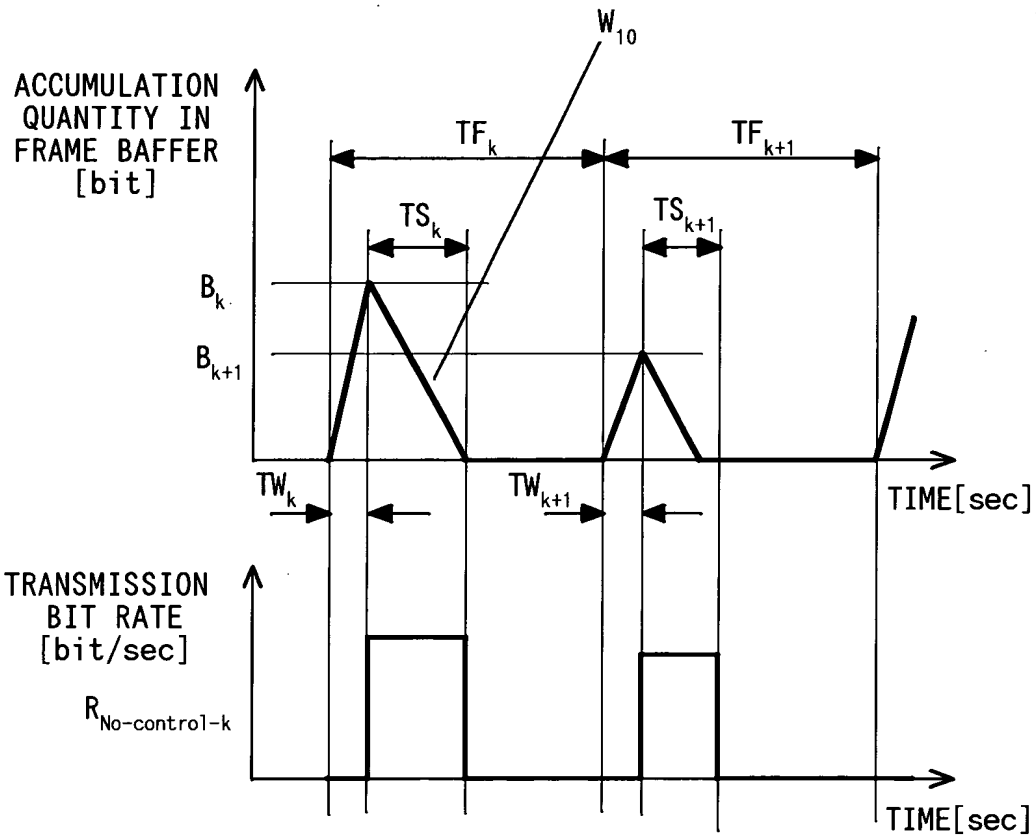

PRIOR ART
10
CAMERA
11
REAL TIME ENCODER
12
FRAME BUFFER
15a
NETWORK TRANSMISSION SECTION
16
17 1
RECEIVER CLIENT #1
17 M
RECEIVER CLIENT #M

Fig. 26

PRIOR ART



09/830,569

Fig. 27

PRIOR ART

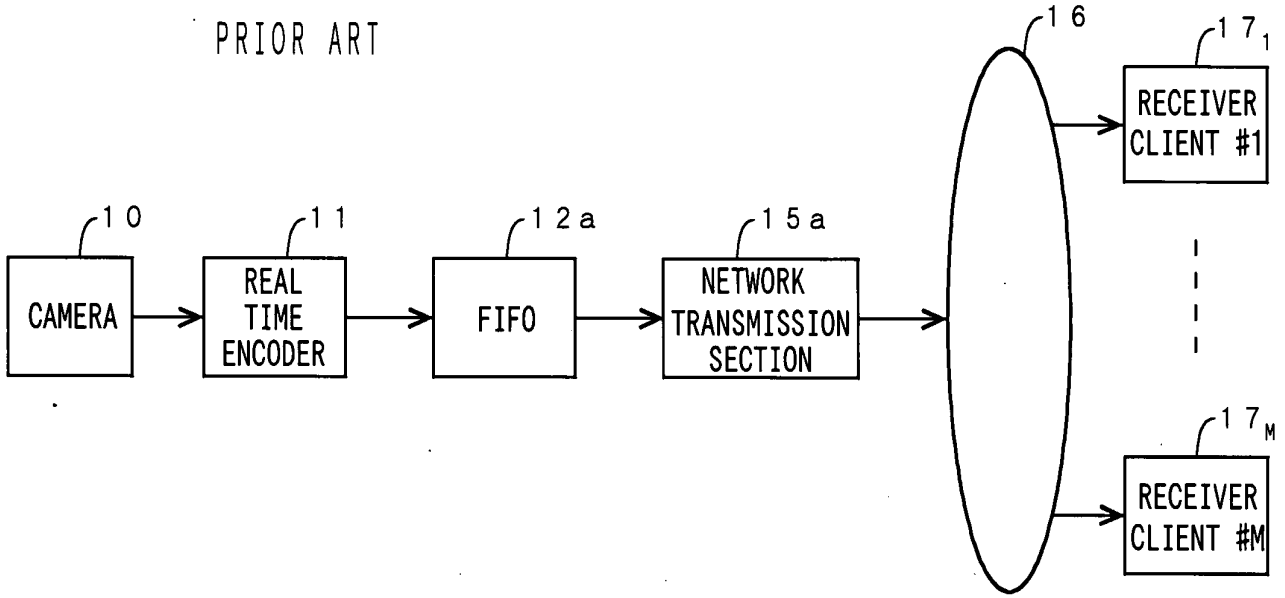
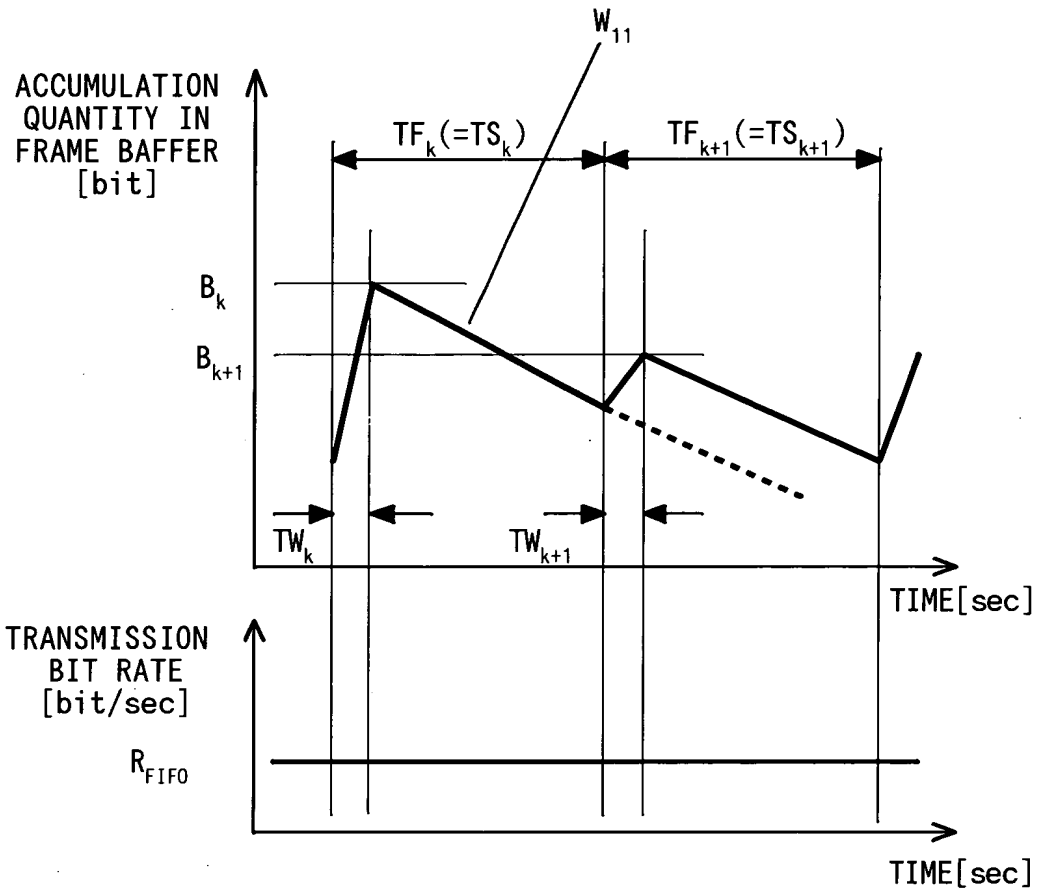


Fig. 28

PRIOR ART



PRIOR ART

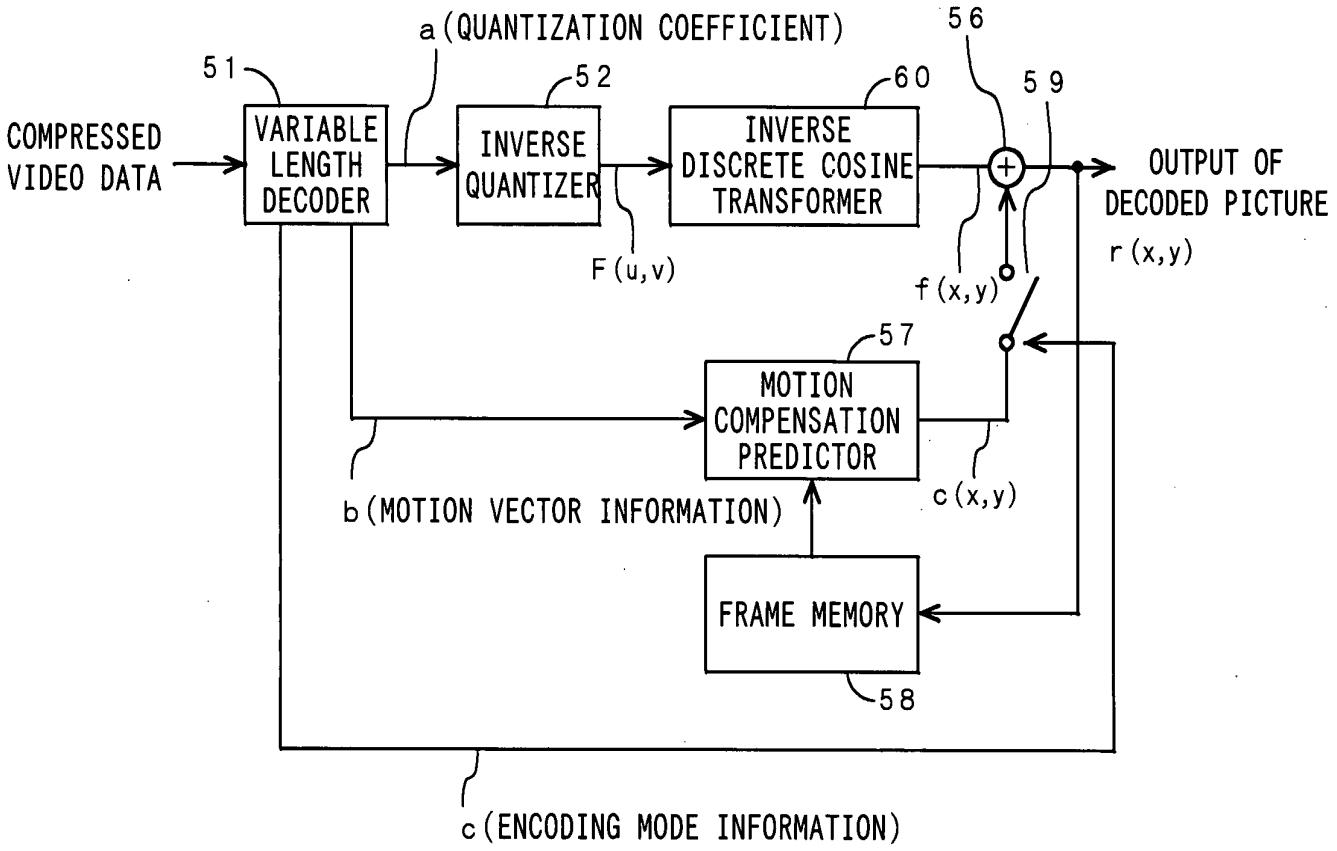



Fig. 29